

Online Research @ Cardiff

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository: <http://orca.cf.ac.uk/114079/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Gritis, Sarah Alexis 2018. Cannabis - current trends and methods of bioavailability. The British Student Doctor Journal 2 (2) , pp. 24-26. 10.18573/bsdj.54 file

Publishers page: <http://dx.doi.org/10.18573/bsdj.54> <<http://dx.doi.org/10.18573/bsdj.54>>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



Cannabis - Current Trends and Methods of Bioavailability

EDUCATION

AUTHOR

Sarah Alexis Gritis

University of St. Andrews
School of Medicine

Address for Correspondence:

Sarah Alexis Gritis
University of St. Andrews
School of Medicine
North Haugh
St. Andrews
KY16 9TF

Email: sag8@st-andrews.ac.uk

No conflicts of interest to declare

Accepted for publication: 23.04.18

ABSTRACT

Summary

There is a growing global trend towards the decriminalisation of cannabis use. Several countries have already legalised this drug for medicinal and recreational use, and more are expected to continue this trend in the future. Inhalation and ingestion of cannabis are the two basic methods of consumption, and each provides unique bioavailability mechanisms. Anticipating the increasing social and legal acceptance of cannabis, this article provides a basic understanding of the geographic acceptance, methods of use, bioavailability of active ingredients, and mechanisms of absorption in the human body.

Relevance

The growing acceptance of cannabis increases the probability that current medical students will encounter patients using cannabis in some form. This is a significant trend especially considering the psychoactive effects of the drug and the medicinal benefits. Having a basic knowledge of the methods of consumption and the longevity of cannabinoid compounds in the human body will help students and practicing physicians better diagnose patients and implement optimum wellness plans.

Take Home Message

As societies and lawmakers increasingly accept the use of cannabis, it's important that medical professionals have a basic knowledge of the various delivery methods and the impact of cannabinoid compounds in the human body. Patient care can be enhanced through a better understanding of how the drug is used and how it affects the human body. This educational piece provides a step in that direction.

Introduction

The global decriminalisation of cannabis is increasingly hitting the newswires these days. With a long-recorded history of human use, this drug contains approximately 60 pharmacologically active cannabinoid compounds including tetrahydrocannabinol (THC) and cannabidiol (CBD), which are known for their psychoactive and non-psychoactive effects respectively. (1, 2) While the popularity of cannabis as a recreational drug is rooted in its ability to alter sensory perception, a growing body of research also points to several medical benefits, including the relief of chronic and neuropathic pain, and as a treatment for insomnia, anxiety, epileptic seizures and nausea. (3, 4, 5, 6, 7, 8)

The Growing Acceptance of Cannabis

The attractiveness of cannabis is growing worldwide. According to the United Nations Office on Drugs and Crime, about 3.8 percent of the global population, or an estimated 183 million people, use cannabis making it the third most popular recreational drug in the world, behind alcohol and tobacco. (9) More importantly, while it is still an illicit substance in many parts of the world, there is a growing trend towards legalisation for medical and recreational use. (10, 11) For example, in Uruguay and Portugal, cannabis is now completely legal, while in countries such as the Czech Republic, Finland, Norway, the Netherlands, Spain and Greece, cannabis is legal for medicinal use or decriminalised in some form. (12, 13) Across the pond in North America, there are 29 U.S. states that have legalised medicinal cannabis and 9 of these have also legalised it for recreational use. (14) This global momentum towards acceptance will continue with the Canadian government slated to become the first G7 country planning to fully decriminalise marijuana in 2018, while further U.S. legalisation is also underway in 8 additional states. (15–17) Although cannabis is still illegal in the United Kingdom, attitudes are changing with roughly half of the public (47%) supporting sale of the drug through licensed shops. (18)

Bioavailability and Longevity of Cannabinoid Compounds

With this growing acceptance, it is especially useful for medical professionals to know how the drug is consumed and the bioavailability of cannabinoid compounds upon entering the body. Firstly, we know that the drug is typically inhaled or ingested, and that smoking is the most common method of inhalation. The bioavailability of the active ingredients and how quickly the psychotropic effects are experienced are affected by several factors, including potency, ratio of THC to CBD, method of delivery, stomach contents, metabolism, biochemistry and interaction with other medications. The act of smoking cannabis provides the highest bioavailability and involves the decarboxylation of the naturally existing tetrahydrocannabinolic acid (THCA) into THC (delta-9-THC). These active ingredients then travel through the airway and into the lungs where they are absorbed into the bloodstream resulting

in maximum plasma concentration within minutes. One study found that inhalation resulted in bloodstream absorption rates of 10 to 45 percent, with bioavailability peaking 3 to 10 minutes after inhalation. (19) Psychoactive effects and increased heart rate are experienced between 30 seconds and 2 minutes after inhalation once the THC compounds reach the brain – and taper off within 2 to 3 hours. (20) In contrast, when cannabis is ingested within foods or drinks it is processed in the highly acidic environment of the stomach, which damages the cannabinoid molecules and reduces bioavailability. Nevertheless, remaining molecules are absorbed in the gastrointestinal tract and liver, which metabolise the THC into 11-hydroxyl-delta-9-THC, a smaller lipophilic molecule able to cross the blood-brain barrier. This results in a more prolonged psychotropic effect compared to inhalation. In two different studies, oral administration resulted in an absorption rate between 4 to 20 percent – the effects are experienced 30 minutes to 2 hours after ingestion and can last up to 8 hours. (21, 22) As an alternative delivery method, there are also cannabis-infused balms, oils and lotions that are absorbed through the skin. This approach activates local cannabinoid receptors and is often used for localized pain relief without the broader psychoactive effects. With all of these methods, the external cannabinoids act on the body's own endocannabinoid system and stimulate cannabinoid CB1 and CB2 receptors, which are involved in the homeostasis of biological functions. For example, the anti-nausea effects of THC are mediated by the interactions of THC with CB1 receptors in the dorsal vagal complex. (23) In contrast, CBD, the second most common cannabinoid, exerts antiemetic properties through other mechanisms and different pathways in the brain resulting in few psychotropic effects.

Conclusion

Societies and lawmakers are increasingly accepting the use of cannabis, especially in light of a growing body of research pointing to various medical benefits. This has resulted in a global trend towards decriminalization, which is expected to encourage future use. Understanding the basic delivery methods of inhalation and ingestion, and the corresponding bioavailability and longevity of cannabis compounds is important in order to better diagnose patients and implement optimum wellness plans.

References

1. Dewey WL. Cannabinoid pharmacology. *Pharmacological Review*. 1986;38:151–178.
PMid:3529128
2. Russo EB, Marcu J. Cannabis Pharmacology: The Usual Suspects and a Few Promising Leads. *Advances in Pharmacology*. 2017;80:67–134.
<https://doi.org/10.1016/bs.apha.2017.03.004>

PMid:28826544

3. National Academies of Sciences, Engineering and Medicine. The Health Effects of Cannabis and Cannabinoids: The Current State of Evidence and Recommendations for Research. 2017 [accessed 20 Feb 18]. Available from: <https://www.nap.edu/read/24625/chapter/6>.

4. Hill KP. Medical Marijuana for Treatment of Chronic Pain and Other Medical and Psychiatric Problems: A Clinical Review. *JAMA*. 2015;313(24):2474-83.

<https://doi.org/10.1001/jama.2015.6199>

PMid:26103031

5. Abrams DI, Jay CA, Shade SB, et al. Cannabis in Painful HIV-Associated Sensory Neuropathy: A Randomized Placebo-Controlled Trial. *Neurology*. 2007;68(7).

<https://doi.org/10.1212/01.wnl.0000253187.66183.9c>

PMid:17296917

6. Cooper ZD, Comer SD, Haney M. Comparison of the Analgesic Effects of Dronabinol and Smoked Marijuana in Daily Marijuana Smokers. *Neuropsychopharmacology*. 2013;38(10):1984-92.

<https://doi.org/10.1038/npp.2013.97>

PMid:23609132 PMCID:PMC3746706

7. Russo EB, Guy GW, Robson PJ. Cannabis, Pain, and Sleep: Lessons from Therapeutic Clinical Trials of Sativex, a Cannabis-based Medicine. *Chemistry & Biodiversity*. 2007;4(8):1729-1743.

8. Porcari GS, Fu C, Doll ED, et al. Efficacy of artisanal preparations of cannabidiol for the treatment of epilepsy: Practical experiences in a tertiary medical center. *Epilepsy & Behavior*. 2018;80:240-246.

<https://doi.org/10.1016/j.yebeh.2018.01.026>

PMid:29429908

9. UNODC - United Nations Office on Drug and Crime. World Drug Report. 2017 [accessed 20 Feb 2018]. Available from: https://www.unodc.org/wdr2017/field/Booklet_2_HEALTH.pdf

10. Gupta S. Why I Changed my Mind on Weed, CNN. 2013 [accessed 20 Feb 2018]. Available from: <https://www.cnn.com/2013/08/08/health/gupta-changed-mind-marijuana/index.html>.

11. Ingraham C. Just how Mainstream is Marijuana? There is a Congressional Cannabis Caucus. *The Washington Post*. 2016 [accessed 20 Feb 2018]. Available from: http://www.washingtonpost.com/news/wonk/wp/2017/02/17/just-how-mainstream-is-marijuana-theres-now-a-congressional-cannabis-caucus/?utm_term=.9dab402901c6.

12. Goni U. Uruguay, the First Country where you can Smoke

Marijuana wherever you like. *The Guardian*. 2017 [accessed 20 Feb 2018]. Available from: <https://www.theguardian.com/society/2017/may/27/marijuana-legalisation-uruguay-seen-half-measure-users>.

13. Masters S. Greece becomes sixth EU country to legalise cannabis for medicinal purposes. 2017 [accessed 20 Feb 2018]. Available from: <https://www.express.co.uk/news/world/824491/Greece-legalises-cannabis-for-medical-purposes>.

14. Barcott, B. Marijuana Goes Main Stream. New York; Time. 2017 [accessed 20 Feb 2018]. Available from: <https://shop.time.com/storefront/books/time-marijuana-goes-main-street/prodTDSHOPMARIJUANABZ.html>.

15. Government of Canada. Legalization and Regulation of Cannabis. 2018 [accessed 20 Feb 2018]. Available from: <https://www.canada.ca/en/services/policing/justice/legalization-regulation-marijuana.html>.

16. Power M. The wild west of weed: will legalization work for Canada. *The Guardian*. 2017 [accessed 20 Feb 2018]. Available from: <https://www.theguardian.com/society/2017/mar/29/the-wild-west-of-weed-will-legalisation-work-for-canada>.

17. Sanders L. 2018. Marijuana Legalization 2018: Which States Might Consider Cannabis Laws this Year? *Newsweek*. 2018 [accessed 20 Feb 2018]. Available from: <http://www.newsweek.com/marijuana-legalization-2018-which-states-will-consider-cannabis-laws-year-755282>.

18. Grice A. Cannabis legalization: 47% support sale of drug through licenced shops, poll reveals. *The Independent*. 2016 [accessed 20 Feb 2018]. Available from: <http://www.independent.co.uk/news/uk/home-news/legalising-cannabis-47-support-sale-of-drug-through-licensed-shops-poll-reveals-a6976796.html>

19. Grotenhermen F. Pharmacokinetics and Pharmacodynamics of Cannabinoids. *Clinical Pharmacokinetics*. 2003;42(4):327-60.

<https://doi.org/10.2165/00003088-200342040-00003>

PMid:12648025

20. Wolf L., Wolf M. *The Medical Marijuana Dispensary*. USA: Althea Press; 2016.

21. Brenneisen R, Egli A, Elshohly MA, et al. The Effect of Orally and Rectally Administered Delta 9-Tetrahydrocannabinol on Spasticity: A Pilot Study with 2 Patients. *International Journal of Clinical Pharmacology and Therapeutics*. 1996;34(10).

PMid:8897084

22. Martin BR et al. Chemistry and Pharmacology of Cannabis. In: Kalant, H., Corrigall WA., Hall W., Smart RG., editors. *The Health Effects of Cannabis*. Toronto: CAMH; 1999. p.19-68.

23. Pacher P, Batkai S, Kunos G. The Endocannabinoid System as an Emerging Target of Pharmacotherapy. *Pharmacological Reviews* 58. 2006;3:389-462.



The British Student Doctor is an open access journal, which means that all content is available without charge to the user or his/her institution. You are allowed to read, download, copy, distribute, print, search, or link to the full texts of the articles in this journal without asking prior permission from either the publisher or the author.

bsdj.org.uk



/thebsdj



@thebsdj



@thebsdj

Journal DOI

10.18573/issn.2514-3174

Issue DOI

10.18573/bsdj.v2i2

This journal is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. The copyright of all articles belongs to **The British Student Doctor**, and a citation should be made when any article is quoted, used or referred to in another work.



Cardiff University Press

Gwasg Prifysgol Caerdydd

The British Student Doctor is an imprint of Cardiff University Press, an innovative open-access publisher of academic research, where 'open-access' means free for both readers and writers.

cardiffuniversitypress.org